

CHAPTER-8

WATER POLLUTION



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WATER



- It is important for the survival of human beings and other creatures.
- Its preservation in qualitative as well as quantitative front is necessary due to scarcity of potable water.

WHAT IS WATER POLLUTION



- **POLLUTION:** is a condition that results from additions of substances increasing their concentration beyond acceptable levels
- **POLLUTANTS :** Is any physical, chemical or biological substances that is identifiable excess is know to be harmful to others desirable living organisms.
- **WATER POLLUTION:** is any physical, chemical or biological change in the quality of water that has a harmful effects on any living thing that drinks or use or lives in it.



SIGNS OF POLLUTED WATER



- Bad taste of drinking water
- Offensive odor from rivers, lakes and ocean
- Decrease in number of fish in fresh water and sea water
- Oil and Grease floating on the surface
- Unchecked growth of aquatic weeds

SOURCES OF WATER POLLUTION



Point Source

e.g.

- ❖ Factories,
- ❖ Sewage treatment plant,
- ❖ Under ground mines,
- ❖ Oil wells,
- ❖ Oil tankers



Non-point Source

e.g.

- ❖ Due to rainfall pollutant will go in river
- ❖ Agriculture run-off
- ❖ Storm water drainage,
- ❖ Atmospheric dispersion
- ❖ Ground water
- ❖ Oil, grease, and toxic chemicals from urban runoff,
- ❖ Sediment from improperly managed construction sites



MAJOR SOURCES OF WATER POLLUTION



**Industrial
Waste**



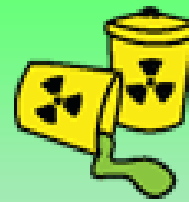
Domestic

Agriculture Activity

**Atmospheric
Deposition**



**Radioactive
Waste**



Eutrophication



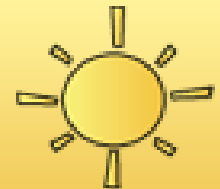
**Oil
Pollution**



**Underground
Storage
Leakages**



**Global
Warming**



**Sewage
and
Wastewater**



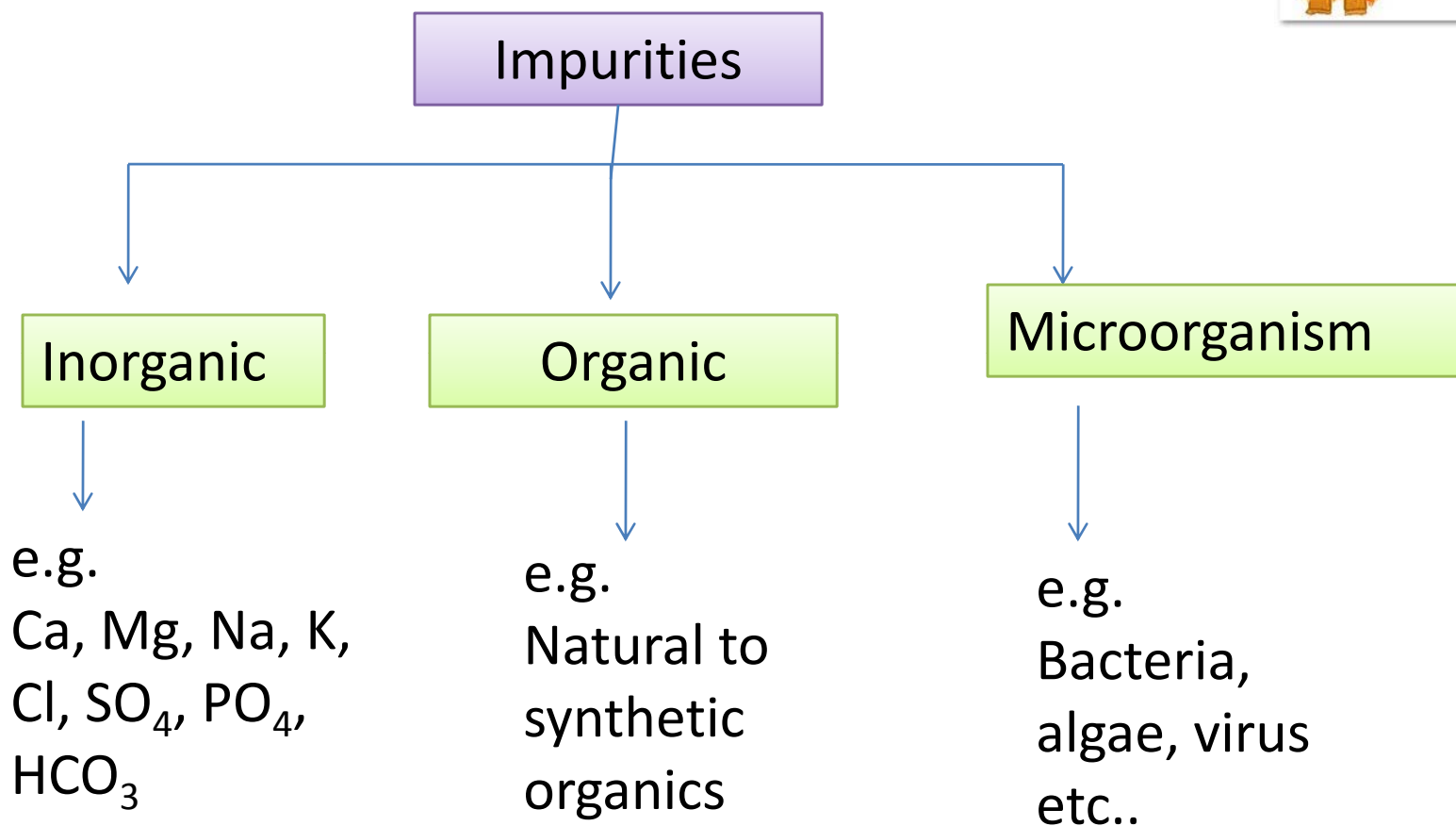
**Marine
Dumping**



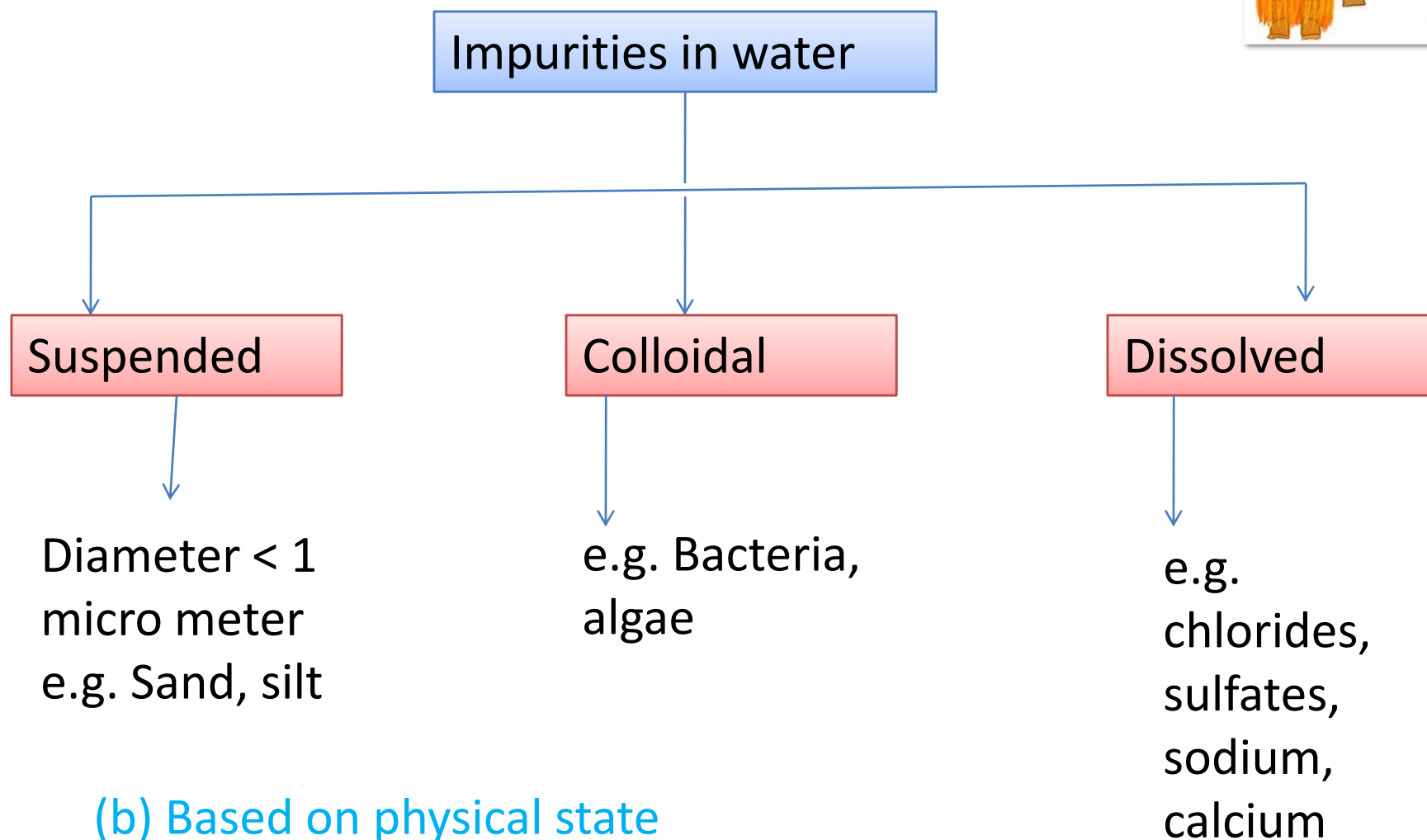
**Commercial
Activity**



IMPURITIES IN WATER

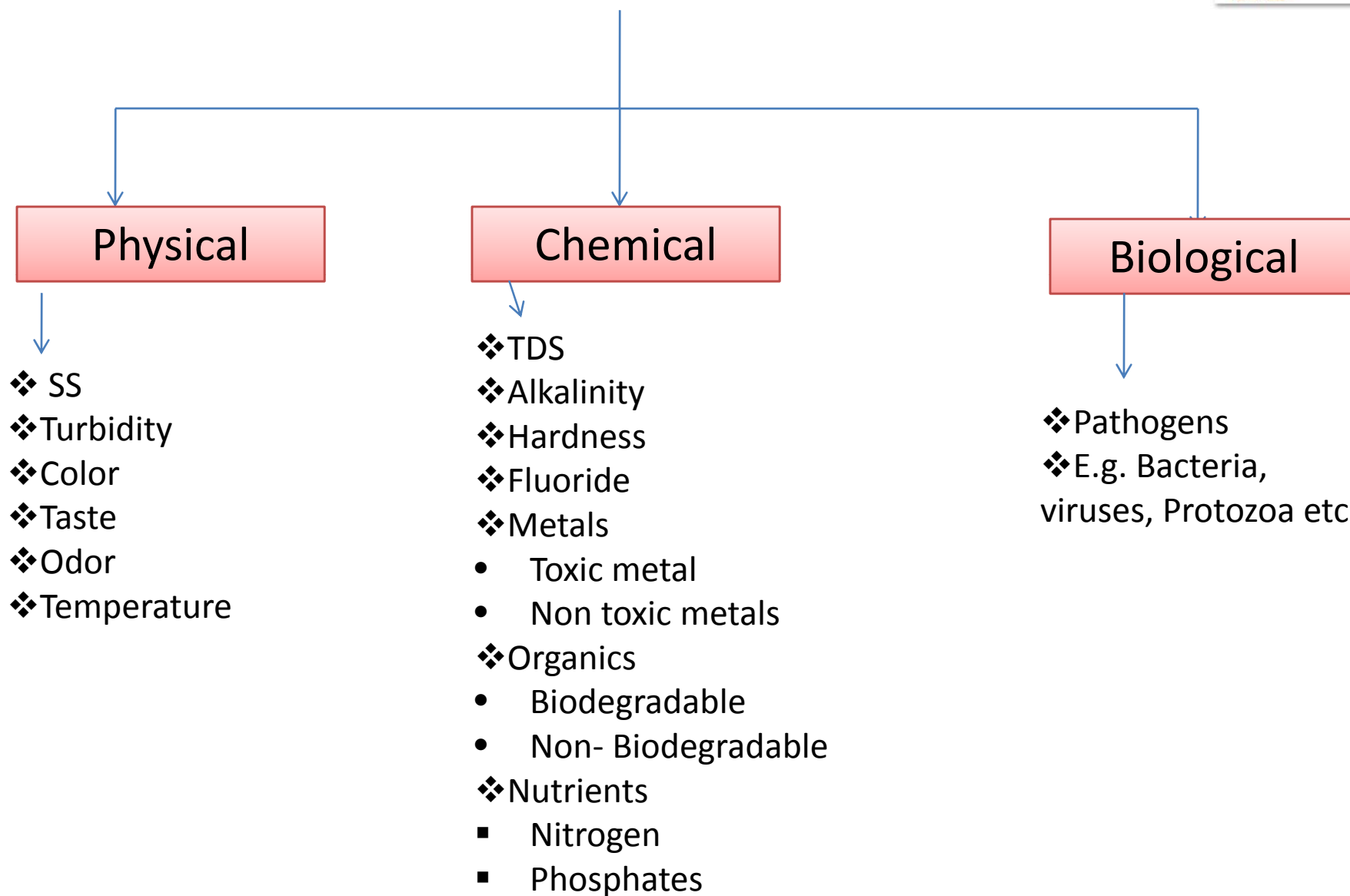


(a) Based on nature of impurities





WATER QUALITY PARAMETERS



IMPORTANT WATER QUALITY PARAMETER MEASURED IN LABORATORY



- Temperature
- Turbidity
- Chlorides
- Hardness
- Micro-organisms
- Alkalinity
- Sulfates
- Heavy metals

INCASE WASTE WATER FOLLOWING PARAMETERS MEASURED ROUTINELY



- pH
- BOD
- COD
- O & G
- TDS
- DO
- SS
- Total Phosphates
- Total Nitrogen
- Color

CLASSIFICATION OF WATER POLLUTANTS



- Suspended matter
- Natural organic pollutants /oxygen demanding waste (sewage and effluent form some industries like dairy, food processing etc)
- Synthetic organic pollutants (Detergent, fertilizers, pesticides)
- Pathogens (Bacteria, virus, Protozoa, worms)
- Inorganic pollutants (acids, alkalis, metals)
- Organic compounds
- Thermal pollutants or thermal discharges
- Sediments
- Radioactive compounds

SAFE DRINKING WATER CHARACTERISTICS



- Free from pathogenic organisms
- Clear or colorless
- Tasty, odorless and cool
- Not saline
- Free from objectionable matter
- Free from compounds that may have adverse effect on human health
- Free from chemicals that cause corrosion of water supply systems
- Have dissolved oxygen and free from carbonic acid so that it remains fresh

DRINKING WATER SPECIFICATION AS PER BIS 10500-1991



Physical:	
Temperature	10 to 15.6 degree Celcius
Color	10 to 20 (platinum cobalt scale)
Chemical:	
TS	Upto 500 ppm
Hardness	75 to 115 ppm (as CaCO_3 eq)
Chlorides	Upto 250 ppm
Iron and Mangnese	Upto 0.3 ppm
pH Values	6.5 to 8
Lead	0.1 ppm
Arsenic	0.05 ppm
Sulphate	Upto 250 ppm



Chemical:	
Carbonate Alkalinity	Upto 120 ppm
DO	5 to 6 ppm
BOD	Nil
Biological	
B- coli	No B- Coli in 100ml
Most probable number	One number in 100 ml
Radiological	
alpha emitters	1 c/liter
Beta emitters	10 c/liter

EFFECTS OF WATER POLLUTANTS



1. Oxygen Demanding waste (Biodegradable organic waste)

- Organic matter which reaches the water bodies is decomposed by microorganisms present in water, for this oxygen dissolved in water is used
- **ORGANIC MATTER + DO (O_2) + Bacteria \rightarrow CO_2 + H_2O**



2. Biochemical Oxygen Demand (BOD)

- Measure → biodegradable matter in water
- It is defined as amount of oxygen required by the bacteria to decompose the biodegradable organic matter under aerobic condition.
- Saturated value of DO → 8 to 15 mg/L
- DO for healthy fish and other aquatic life → 5 to 8 mg/L
- Degradation of waste → DO decrease → DO = 4 mg/L fish and other aquatic animal will killed
- Other effects to reduced DO → increase taste, odor, color, prohibiting the use of domestic and recreational purposes

3. Pathogens



- Many waste water especially sewage contains many pathogenic microorganisms which are usually contained faeces and urine of the infected person.
- Water borne diseases like cholera, dysentery, typhoid are cause pathogens are present in water

4. N₂ and Ph compound



- It helps growth of algal and other plants
- Nutrient growth → cause algal bloom
- Growth of weed increase → cover surface area → reduce to pass sunlights
- Aquatic plant along algae will die → water decompose with dead plant → decay organic matter add unwanted color, taste, odor → reduces DO in water → death of fish and other aquatic plant → this process is called Eutrophication



5. Toxic compound

- Pollutants such as heavy metal, pesticides, methyl mercury, cyanides, many other organic and inorganic compound are harmful to aquatic organisms.
- e,.g: DDT (Not dissolved in water)
- Mercury dumped in water → converted into methyl mercury by bacterial action. → A disease is called Minamata disease occurs due to consumption of methyl mercury contaminated fish.
- Concentration of Nitrate > 45 mg/L cause blue baby diseases
- Excess fluoride → fluorosis (effects bones and teeth of the person)



6. Suspended matter

- Makes water aesthetically displeasing
- Biodegradable SS cause DO depletion
- Reduce light penetrates → reduce photosynthesis → loss of food production
- Provides adsorption sites for harmful chemicals or biological organisms which can effect flora and fauna of stream



7. Thermal Discharge

- Increases biological activities.
- Cause death of some heat sensitive organisms
- DO concentration decreases → increase biological activity at high temperature → results anaerobic condition → results bad odor
- Growth of algae increases
- Toxicity of chemical pollutants increases with increases in temperature.

EUTROPHICATION



- Eutrophication → Greek word → “EU” = Well and “TROPHS”= food → Thus its means “ Well Food” or “ Nutrient rich”
- Thus Eutrophication means excessive nutrient load in a water body or enrichment of water body by nutrients
- Nutrient may become pollutant if their concentration is sufficient to allow excessive growth of aquatic plants especially algae

CONT...



- Depend upon the increasing levels of productivity, the water bodies can be classified in to:
- **Oligotrophic:** Water with **poor** nutrient status and **very low** productivity of aquatic plant
- **Mesotrophic:** Water with **moderate** nutrient status and **moderate** productivity of aquatic plant
- **Eutrophic:** Water with **rich** nutrient status and **high** productivity of aquatic plant

CONT...



- Young lake → very low productivity
- With the time increase → surface run off from agriculture field, domestic sewage increase aquatic growth.
- This way it convert **Oligotrophic to Eutrophic**
- With time more nutrient water body gradually increase. This lead **biological productivity and algal bloom** occur. The lake thus become **Eutrophic**.
- Eutrophication → take place → thousand of year → because of human activity

CONT...



- Industrial waste, surface run off from agriculture field, domestic sewage → plenty of phosphates and nitrates → cause algal growth → water body become green → algal bloom occur → DO level depleting → bad taste and odor occur → turbidity increases → reduce the use of water for domestic purpose → because of silt and gravel → more plant occur shallow edge → lake convert into marsh and finally convert into dry land

CONTROL OF EUTROPHICATION



- The main cause of algae \rightarrow C, N, Ph \rightarrow if supply of this restricted \rightarrow growth will reduce
- C is available naturally so can not be restricted \rightarrow N is also fixed from atmosphere by some bacteria and blue green algae \rightarrow so it is too hard to restrict \rightarrow Ph is least available to atmosphere \rightarrow so we can restrict to Ph for algal bloom

CONT...



- The main source of Ph → agriculture field (fertilizers) and domestic sewage(washing of detergent) → so we can to restricted this but we use limited
- Other steps **recycling of nutrients** through harvest, **removal of algal bloom by dredging, applying algaecides like copper, sulfates, chlorine on water bodies**
- Entry of Ph can remove by → collect domestic sewage in septic tank → **do proper treatment** → **then safe disposal**
- Use of fertilizer in drainage are **reduce the entry of Ph by surface run off** a can be controlled by → to to field to lakes
- It can also reduce by methods **to reduce soil erosion**
- Also **lime** can be use for removal f Ph by precipitation

CONTROL OF WATER POLLUTION



- ETP (Effluent Treatment Plant)
- CETP (Common Effluent Treatment Plant)
- STP (Sewage Treatment Plant)

WASTE WATER TREATMENT



Primary treatments:

- Screening
- Grit chamber
- Oil and grease trap
- Equalization and neutralization
- Coagulation and flocculation
- Sedimentation tank (settling tanks or clarifier)
- Flash mixture

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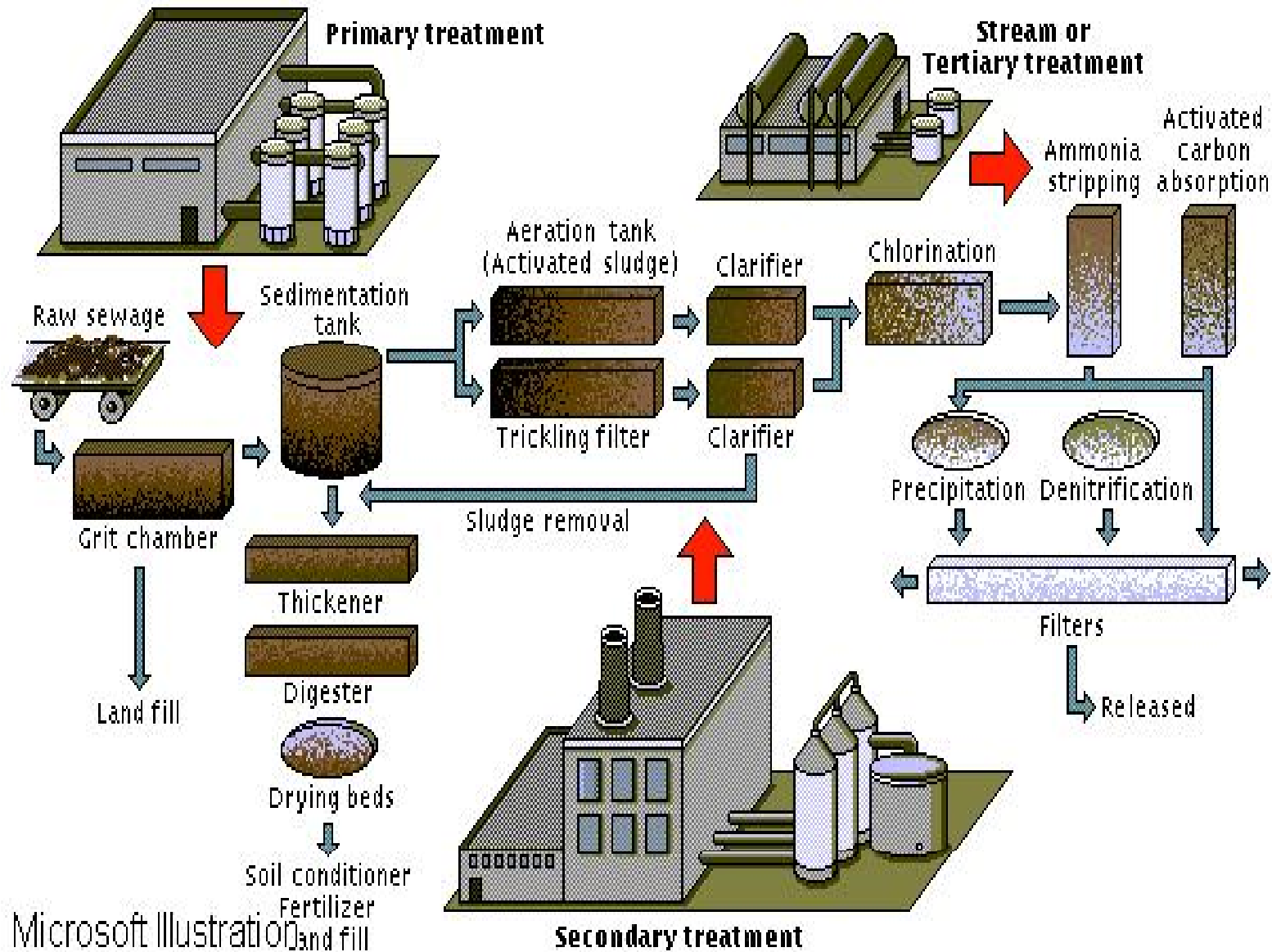


Secondary treatment

- Activated Sludge process
- Trickling Filters
- Lagoons
- Oxidation Ponds
- Anaerobic digestion

Tertiary treatment

- Chlorine (or other disinfecting compounds, or occasionally ozone or ultraviolet light)
- RO (Reverse Osmosis)
- Filtration
- Desalination
- Colloidal removal



Microsoft Illustration

OTHER MEASURES FOR CONTROL OF WATER POLLUTION



- By enforcing stringent standards for disposal of sewage and industrial waste in to water bodies
- Washing of clothes and taking bath directly in river lake which supply of drinking water should be prohibited
- Pesticides and fertilizers used reduces chemical pollution due to surface runoff from farms.
- Less stable pesticides should be used
- Increase vegetation covers to reduce water pollution due to soil erosion
- Reuse of water
- To avoid thermal pollution hot water should be cooled before releasing to water bodies
- Advanced treatments for removal of nitrates and phosphates should be adopted to prevent Eutrophication.

GOVERNMENT MEASURES FOR WATER POLLUTION CONTROL



THE GOVERNMENT OF INDIA HAS ENACTED A NUMBER OF LEGISLATION SUCH AS

- Water (Prevention and Control of Pollution) Act, 1974 and amended in 1988
- Water (Prevention and Control of Pollution) Cess Act, 1977 and amended in 1991
- Environmental Protection Act, 1986

DO'S AND DON'TS



Sr. No.	Do's	Don'ts
1	Reuse water whenever and wherever possible. Kitchen water can be used for watering plants	Don't keep tap running while having bath, brushing teeth or washing dishes. It waste about 2 litres of water every minutes
2	Plan your kitchen activity to avoid wastage of food and water	Don't house off your lawn or corridor to clean it. Sweep it off.
3	Fix leaks promptly. A dripping joint can waste 76 liters of water a day	Don't wash the clothes and kitchen utensils in water bodies
4	Take showers instead of baths. Showers use less water: if you limit them to five minutes. Install low-flow shower heads	Avoid throwing flowers, sweets, puja material into a river. It will degrade the quality of water
5	Use sprinkler for irrigation	Don't litter
6	Use scientific methods of fertilizer application	Avoid throwing dead bodies in river
7	---	Avoid use of weedicides
8	---	Never dump any thing into the water bodies

TUTORIAL-8

WATER POLLUTION



1. Give definition of (1) water pollution, (2) whole some water (3) Point source (4) Area source (5) Biochemical Oxygen demand (BOD) (6) Suspended particles (7) Colloidal particles (8) Dissolved particles
2. What are the classification of water pollutant?
3. Give water quality standard as per ISI ?
4. Write a short note on Eutrophication. OR Explain Eutrophication in detail and how do we control it?
5. Describe control of water pollution
6. What are the sources of water pollution? What are the type of impurities in water?
7. Describe the different water pollutants which make water unfit for drinking?
8. Give the causes of following diseases (1) Minamata (2) blue baby diseases (3) Fluorosis
9. What are the effects of water pollutant? Explain every one in detail
10. State the different parameters of which are to be tested for determining the quality of water

TUTORIAL-9

AIR POLLUTION



1. Define Air pollution. Describe classification of air Pollutants
2. Explain the effects of air pollution on human being
3. Explain the effects of air pollution on plants and animals
4. What are the different sources of Air pollution?
5. Enlist different air pollutant with their sources and effects? **OR** What are the sources and Effects of CO, CO₂, NO_x, SO_x, HC, Photo chemical Oxidants, Particulate air Pollutants?
6. Write a short note on control of air pollution. OR what are the preventive measures and control measures to control of air pollution
7. State the Indian ambient air quality standards



END

SAVE WATER. SAVE LIFE.

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